Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Spectrum Horizons	)	ET Docket No. 18-21
	)	
James Edwin Whedbee Petition for Rulemaking to Allow Unlicensed Operation in the 95-1,000 GHz Band	)	RM-11795

To: The Commission

REPLY COMMENTS OF
THE BOEING COMPANY

The Boeing Company ("Boeing") hereby replies to the comments that were filed in response to the Commission's Notice of Proposed Rulemaking ("NPRM") addressing the use of frequency bands above 95 GHz for experimentation, innovation, and commercial applications.[1]

The comments of the parties reflect near unanimous consensus within the communications and information industries that the Commission should not rush the process of adopting service rules and regulations for commercial operations in the frequency bands above 95 GHz. Although some spectrum in this range should be made available in the near term for new commercial services, caution should be exercised to avoid precluding the development of new technologies and services that have not yet been identified, and to ensure the protection of important satellite and passive services already operating in these frequencies.

[1] In the Matter of Spectrum Horizons, *et al.*, ET Docket No. 18-21, *Notice of Proposed Rulemaking*, FCC 18-17 (Feb. 28, 2018) ("*NPRM*").

I. NEARLY ALL COMMENTERS SUPPORT CAUTION AND PATIENCE IN IDENTIFYING AND ADOPTING RULES FOR NEW SERVICES IN THE BANDS ABOVE 95 GHZ

The comments that were filed in this proceeding urged the Commission toward a measured approach in assigning spectrum and adopting services rules for the bands above 95 GHz. As commenters explain, "[g]iven the nascent nature of the communication technologies using the bands above 95 GHz, the Commission must not pick winners or losers."[2] Instead, "the marketplace should have the opportunity to dictate the highest and best uses of these frequencies. The Commission should therefore make limited, if any allocation of this spectrum now,"[3] and "refrain from imposing rigid rules that may restrict or foreclose services from being deployed in these bands."[4] "Opportunities for innovation . . . can be established without adopting service rules at this time. Indeed, establishing service rules too early could foreclose options for innovative new technologies that have not yet been imagined."[5]

The commenters also agree that the Commission should encourage the development of all forms of communications services, including those that have not yet been addressed in the Commission's regulations. Thus, the Commission should "accommodate the entire range of possible uses for the mmW bands, providing a variety of lightly-licensed and unlicensed approaches to ensure that operators can utilize these bands to work harmoniously with low, mid, and other higher frequency bands."[6]

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[2] *CTA Comments* at 6.

[3] *Wi-Fi Alliance Comments* at 1.

[4] *CTIA Comments* at 3.

[5] *Google Comments* at 1-3.

[6] *CTA Comments* at 6.

To this end, the Commission "should consider a framework that allows for the coexistence of multiple platforms and users" and "ensure that its decisions do not preclude any of these potential use cases or other future innovations."[7] Expressed more firmly, "[p]remature or overly restrictive spectrum regulation . . . results in inefficiencies, opportunity costs, and that 'familiar scenario' of managing or relocating incumbents when the optimal use for allocated spectrum changes over time."[8] Consistent with this consensus-based guidance, Boeing summarizes as follows its recommendations with respect to the frequency bands above 95 GHz.

A. The Commission Should Authorize Fixed Services in Limited Portions of the Bands Above 95 GHz Using Service Rules That Adequately Protect Passive and Earth Exploration Satellite Services

Boeing recognizes that interest already exists with respect to the operation of fixed services ("FS") in the bands above 95 GHz. As explained by several parties, the very high data rates and speeds made available by these frequencies will be needed to support wireless 5G backhaul in those locations where mobile UMFUS services are commercially deployed.[9] Therefore, Boeing agrees that at least some portion of the 36 GHz of spectrum that is allocated to FS and is not shared on a co-primary basis with commercial satellite services should be made available for FS. As discussed below, however, it may also be appropriate to make portions of this 36 GHz of spectrum available for unlicensed or possibly a mix of licensed and unlicensed use.

In developing technical rules for FS in this spectrum, caution must be exercised to ensure the protection of passive and earth exploration satellite services ("EESS") that support critical

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[7] *Facebook Comments* at 3.

[8] *Apple Comments* at 4.

[9] *See, e.g., CTA Comments* at 4-5.

science and meteorological services used for logistics and public safety. Although some parties have advocated for more flexible technical rules for FS in the bands above 95 GHz, they have not conducted technical studies in cooperation with the scientific community on the potential impact of these proposals on passive and EESS operations. Until such studies have been completed, the Commission should refrain from adopting service rules for FS in frequency bands that are shared with or adjacent to passive and EESS allocations.

B. The Commission Should Refrain from Authorizing Mobile Services in the Bands Above 95 GHz Pending Further Technological Development

Even the most ardent proponents of mobile services appear to acknowledge that "technology does not exist today to support mobile applications in frequencies above 95 GHz"[10] and "there may be little present interest in using the above-95 GHz spectrum for mobile services."[11] It is therefore premature to identify specific spectrum bands for mobile services, or to adopt spectrum sharing rules to accommodate the future possibility of commercial mobile operations. The Commission could, however, place other spectrum users on notice that the Commission may attempt to introduce mobile services in certain frequency bands at some point in the future, such as in portions of the 36 GHz of spectrum that are allocated on a primary basis to fixed and mobile services and are not shared with commercial satellite service allocations.

C. The Commission Should Preserve Spectrum for Future Commercial Satellite Services Using Site-by-Site Coordination for any Sharing with FS

Given that 36 GHz of unshared spectrum is already available for fixed and mobile services in the bands above 95 GHz, Boeing does not support at this time the introduction of fixed or mobile

[10] *T-Mobile Comments* at 5.

[11] *mmWave Coalition Comments* at 4.

services in the 66.2 GHz of spectrum that is shared on a co-primary basis with commercial satellite services. Boeing acknowledges, however, that site-by-site coordination between FS and satellite earth stations should be relatively easy in this spectrum. As T-Mobile explains, "[m]any links can coexist in the same geographical area because tighter beams are less likely to cause interference."[12] Ericsson makes this same point, explaining that "[t]he fixed point-to-point antennas used above 95 GHz will transmit very narrow 'pencil beams,' and the propagation properties of those transmissions substantially limit the length of the links. Thus, assuming proper coordination, the likelihood of interference from fixed point-to-point services to other licensed services is small, and vice-versa."[13]

Given this, if the Commission does introduce FS into any of the bands that are shared with satellite services, the Commission should use of the same coordination approach that is currently used in the 70 and 80 GHz bands. As Qualcomm explains, "[t]he fact that sharing between point-to-point operations and satellite operations has worked in bands below 95 GHz is proof positive that it can work above 95 GHz where the point-to-point beams are even more tightly focused and less likely to cause interference to satellite operations."[14] CTIA concurs, explaining "the existing 70/80/90 GHz database approach should be applied to any future FSS earth stations."[15]

This said, the Commission should disregard T-Mobile's baseless claim that efforts to make additional spectrum capacity available for commercial satellite operations are "misguided."[16]

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[12] *T-Mobile Comments* at 4.

[13] *Ericsson Comments* at 17.

[14] *Qualcomm Comments* at 9-10.

[15] *CTIA Comments* at 11-12.

[16] *T-Mobile Comment*s at 13.

The satellite industry has long been a heavy user of millimeter wave ("mmW") spectrum in the Ka-band to support broadband satellite services to end users in all locations, from large cities to rural and remote area untouched by terrestrial distribution technologies.[17] In contrast, spectrum allocations in the Ka-band for terrestrial technologies continue to be largely fallow. Boeing anticipates a similar development pattern with respect to direct-to-end user services operating in progressively higher mmW spectrum allocations and the Commission should continue to manage scarce spectrum resources accordingly.

D. The Commission Should Identify Additional Spectrum for Unlicensed Devices, Including in Bands that are Not Shared with Passive Services

Numerous commenters echoed Boeing's position that the *NPRM* does not identify sufficient spectrum resources for unlicensed services in the bands above 95 GHz.[18] As Apple argues, "[b]y proposing that only a small fraction of the spectrum it allocates should be available for unlicensed use, the Commission reduces the band's potential to support new innovation and growth."[19]

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[17] *See SIA Comments* at 10-12.

[18] *See Qualcomm Comments* at 10-11 (urging the Commission "to consider opening additional spectrum bands above 95 GHz to unlicensed use"); *CTA Comments* at 7-8 (supporting proposals for unlicensed spectrum bands); *Facebook Comments* at 4 (supporting more "equal allocations among unlicensed, lightly licensed, and exclusively licensed frameworks within this spectrum"); *Bosch Comments* at unnumbered page 10 (identifying additional spectrum for unlicensed use); *IEEE 802 LAN/MAN Standards Committee Comments* at unnumbered page 2 (supporting additional spectrum for unlicensed use); *Starry Comments* at 7 (supporting even more unlicensed spectrum); *Wi-Fi Alliance Comments* at 4 (explaining that the Commission's current proposal for 15.2 gigahertz of unlicensed spectrum "may prove insufficient to allow unlicensed operations above 95 GHz and inadvertently, serve to handicap some technologies while advantaging others").

[19] *Apple Comments* at 5.

In seeking to identify additional spectrum for unlicensed operations in the bands above 95 GHz, the Commission should be particularly focused on bands that are not shared with or adjacent to passive or EESS services. Although it may be possible for terrestrial-based unlicensed devices to adequately protect passive and EESS operations in the bands above 95 GHz, significant technical constraints may be needed to enable the operation of such unlicensed devices on aircraft or space systems, where emissions into sensitive passive and EESS systems could be more likely. Therefore, additional unlicensed spectrum allocations should be identified that are not proximate to such sensitive services.

E. The Commission Should Make Targeted Improvements to its Experimental Licensing Rules

Boeing continues to oppose the creation of a new experimental license service for the bands above 95 GHz, advocating instead for improvements to the existing experimental license regimes. As Google explained, "[a]fter the Commission adopted rules to create the Program Experimental License and other new experimental license schemes under Part 5, it took more than four years to build infrastructure (including a website) to implement the revised framework.[20]

In supporting improvements to the existing experimental license process, Boeing notes that other parties supported extending the term for most experimental licenses to ten years, but with a mid-term reporting requirement to ensure ongoing compliance.[21] Boeing could support this approach, along with a relaxation of eligibility requirements for experimental licensees. Boeing, however, does not support permitting unlimited sales of experimental devices to third parties. As the National Radio Astronomy Observatory explained, the combination of a ten year license term

[20] *Google Comments* at 7.

[21] *See id.* at 6.

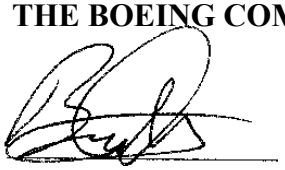
and relaxed marketing rules makes "little sense in an area of rapidly developing technology but might well encourage a licensee who profits from marketing an otherwise-illegal transmitter to squat while conducting what is in essence a bootleg commercial operation."[22] Instead, the Commission should retain its requirement that experimental licensees maintain ownership and ultimate control of experimental devices during marketing trials that are conducted pursuant to an experimental authorization.

II. CONCLUSION

The frequency bands between 95 and 275 GHz represent the last green field opportunity for at least a generation of RF innovation. Although the Commission should encourage experimentation and development using frequencies above 95 GHz, the Commission should also preserve as much of this spectrum as possible in order to ensure that it remains available for future generations of innovation and new applications and uses that remain beyond our current perception.

Respectfully submitted,

THE BOEING COMPANY

By: 

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[22] *NRAO Comments* at 4.